Claims

1. A semiconductor optical waveguide device comprising a semiconductor layer having an upper surface, and a lower surface which is defined by a lower confinement layer, the semiconductor layer having formed therein:
   (a) a waveguide;
   (b) at least one recess adjacent to the waveguide and extending from the upper surface of the semiconductor layer;
   (c) at least one doped region, at least part of which is situated between a said recess and the lower confinement layer; and
   (d) at least one trench adjacent to a said doped region and recess and situated on an opposite side thereof to the waveguide, wherein the (or each) trench extends from the upper surface of the semiconductor layer.

2. A device according to Claim 1, wherein the (or each) trench is deeper than its adjacent recess.

3. A device according to Claim 1 or Claim 2, in which the (or each) recess is spaced apart from its adjacent trench.

4. A device according to Claim 1 or Claim 2, in which the (or each) recess is not spaced apart from its adjacent trench, so that the recess and trench comprise a single larger feature.

5. A device according to any preceding claim, in which the (or each) doped region extends substantially to the lower confinement layer.

6. A semiconductor optical waveguide device comprising a semiconductor layer having an upper surface, and a lower surface which is defined by a lower confinement layer, the semiconductor layer having formed therein:

(a) a waveguide;

(b) at least one doped region extending substantially to the lower confinement layer; and

(c) at least one trench adjacent to, and spaced apart from, a said doped region and situated on an opposite side thereof to the waveguide, wherein the (or each) trench extends from the upper surface of the semiconductor layer.

7. A device according to any preceding claim, in which the (or each) trench extends substantially to the lower confinement layer.

8. A device according to any preceding claim, in which the waveguide is a rib waveguide, comprising a rib portion.

9. A device according to any preceding claim, in which the semiconductor comprises silicon.

10. A device according to any preceding claim, in which the lower confinement layer is a confinement layer for electrical charge carriers.

11. A device according to any preceding claim, in which the lower confinement layer is a confinement layer for an optical mode propagated by the waveguide.

12. A device according to any preceding claim, in which the lower confinement layer is an electrically insulating layer.

13. A device according to any preceding claim, in which the lower confinement layer comprises silica.

14. A device according to any preceding claim, in which there is a substrate layer below the lower confinement layer.

15. A device according to Claim 14, in which the substrate layer comprises silicon.

16. A device according to any preceding claim, in which there are two said doped regions, the doped regions being situated on opposite sides of the waveguide.

17. A device according to Claim 1 or any claim dependent thereon, in which there are two said recesses, the recesses being situated on opposite sides of the waveguide.

18. A device according to any preceding claim, further comprising an additional doped region.

19. A device according to Claim 18 when dependent upon Claim 8, in which the additional doped region is situated in the rib portion of the rib waveguide.

20. A device according to any preceding claim, in which there are two said trenches, the trenches being situated on opposite sides of the waveguide.

21. A device according to Claim 16 or any claim dependent thereon, in which the doped regions comprise n-doped and p-doped regions.

22. A device according to any preceding claim, which comprises a p-i-n diode.

23. A device according to Claim 22, which comprises a lateral p-i-n diode.

24. A device according to any preceding claim, which comprises an optical modulator.

25. An apparatus comprising a plurality of devices according to any preceding claim.

26. A device substantially as hereinbefore described and/or as illustrated in the accompanying drawings.